Steven Pliam/VA Polytechnic Institute

New life for the evil leaf? Tobacco's reputation may be redeemed if it becomes a viable producer of human proteins.

to express a bacterial gene used to produce a human anticoagulant. Cramer infected tobacco leaf with the bacteria and used it to grow dozens of transgenic plants producing the human blood protein. She is now extracting the protein and testing it to see if it has the same qualities as protein produced by humans. Although it may be years before any direct medicinal benefit is derived from tobacco, scientists are predicting that these new uses may be the savior of the small tobacco farmer and turn tobacco from an instrument of harm to an instrument of healing.

Cyber-schnoz

To find answers to difficult questions, people have, for years, been exhorted to follow their noses. Scientists seeking to understand how environmental toxins affect animals and people have taken this statement literally—well, almost. Researchers at the Chemical Industry Institute of Toxicology are using an innovative new tool—a computer-generated rat's nose—to study the effects of chemicals.

Toxicologists studying rat inhalation have found that how a chemical toxin affects an animal, or possibly a person, depends, in part, on where the chemical deposits in the respiratory system. Because inhalation studies are expensive and difficult because of the numbers of animals required, researchers began to look for another way to get the same information, thus the cyber-schnoz. Kevin Morgan, a biologist and veterinarian, and Julie Kimbell, who holds a Ph.D. in differential geometry, worked for five months at CIIT, a not-for-profit, industry-funded toxicology laboratory, developing a three-dimensional computer model of the inside of a three-month-old rat's right nostril.

Using the finite elemental method of solving complex geometrical equations and more than 600 slides of rat nasal passages, Morgan and Kimbell devised a model of the virtual reality nose that allows them to simulate air carrying environmental toxins throughout the nasal passages. So far, they have used the model to examine where chemicals such as formaldehyde and ozone deposit in the nasal passages. According to Morgan, they hope to eventually use the model to study all types of reactive gases, vapors, and particles. They hope to be able to extrapolate this information to tell how these chemicals may affect the human respiratory system.

Morgan and Kimbell use two different methods to judge the accuracy of the information generated by the computer nose. In the first method, they compare the uptake pattern of the distribution of formaldehyde generated by the computer with actual patterns of nasal lesions in rats exposed to formaldehyde. In the second method, photo developer is poured into a laboratory flow tank containing a geometric pattern on film which simulates the rat nasal passages. The rate of development of the film creates a pattern that the researchers can correlate with the computer simulation to test its validity. Regarding the rate of correlation, Morgan said, "We've found it to be extremely good."

Still, the "technose" has its limitations. For this reason, Morgan and Kimbell are working to develop human and rhesus monkey computer nose models. The human nose project used magnetic resonance imaging and CAT scans to generate the necessary coordinates. According to Morgan, who is working primarily on this project, they are now ready to begin constructing a model. The rhesus monkey nose model, being developed through a cooperative agreement with the EPA, is much further along. Kimbell has begun the first air flow tests on the rhesus monkey nose, which is much larger and much more similar to a human nose than the rat's. Said Morgan, "The monkey is a good intermediate between the rat and human." At least some laboratory rats can now breathe a sigh of relief.

Age-old Genetic Questions

Knowing that tumor incidence increases with age and that certain gene mutations are critical events in tumor formation, scientists have long supposed that genetic mutations leading to cancer increase with age. Until recently there was no direct evidence of this hypothesis, but researchers at the University of Southern California have now demonstrated that mutations in the oncogenes responsible for non-Hodgkin's lymphoma accumulate over the lifetimes of some individuals, perhaps putting them at greater risk for developing cancer.

"Age is the single most significant risk factor for cancer, and the incidence of most cancers rises exponentially with age, said Gino A. Cortopassi, assistant professor of molecular pharmacology and toxicology at the USC School of Pharmacy who led the experiment, in an article by the Associated Press. Knowing that the incidence of non-Hodgkin's lymphoma increases over 40-fold with age, Cortopassi and colleagues used a technique called polymerase chain reaction to examine peripheral blood lymphocytes from 53 live patients and 31 autopsies, none of whom had non-Hodgkins lymphoma. The team was looking for translocation mutations in the *BCL2* (B-cell leukemia/lymphoma-2) gene known to be associated with the disease. The mutations are found in about half of all cases of non-Hodgkin's lymphoma.